ESRL Physical Sciences Laboratory Review
Global Systems Division (GSD) Overview

Dr. Steven E. Koch, Director

March 9–12, 2010

Outline

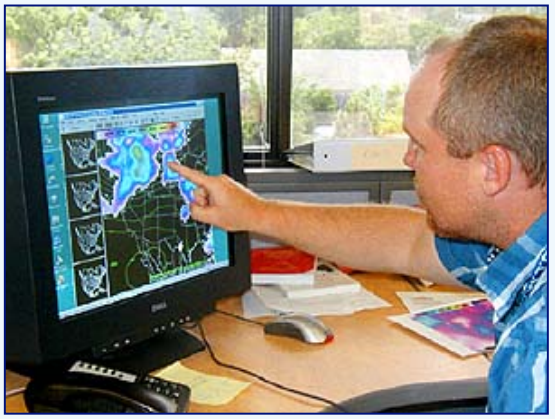
- Relevance of GSD Mission to NOAA & Society
- GSD Organization and Workforce Character
- Measures of Research Quality and Performance
- Impacts of GSD Research, Products and Services
- Performance: Leadership and Research Strategies
- Future Challenges

Mission Statement

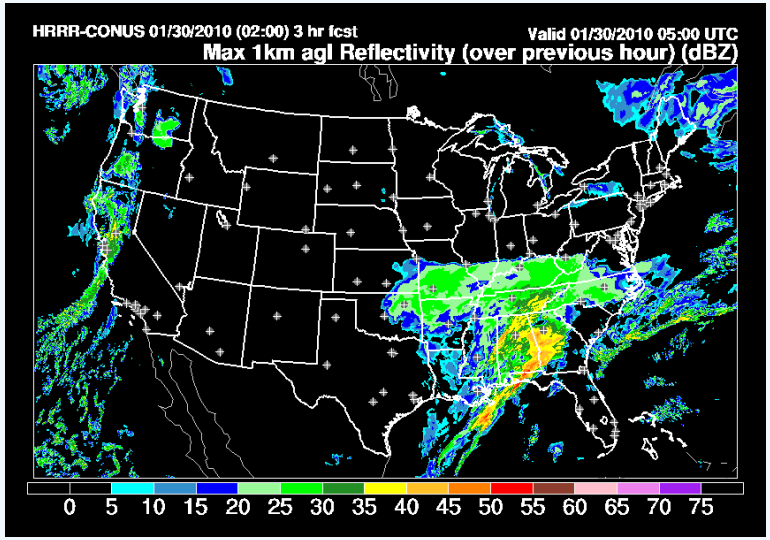
Global Systems Division conducts research and development to provide NOAA and the nation with observing, prediction, computer and information systems that deliver environmental products ranging from local to global predictions of short-range, high impact weather and air quality events to longer-term intraseasonal climate forecasts.

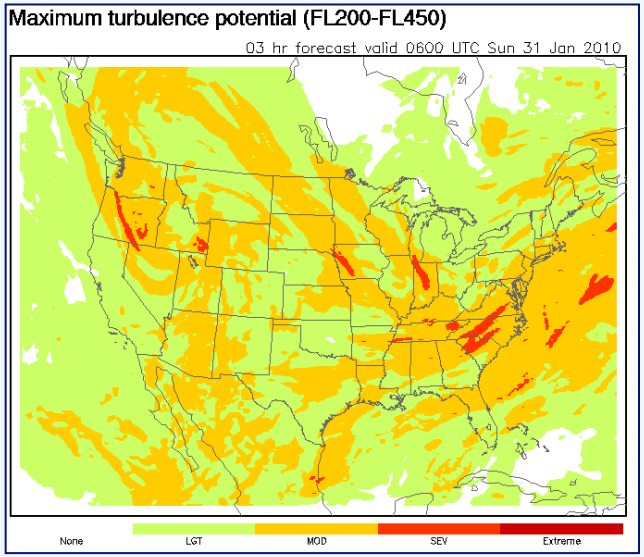
Strategic Mission Shift (Directed by Creation of ESRL in Oct 2005)

FSL (Director: A. E. MacDonald Prior to Feb 2006)		GSD (Director: S. E. Koch after Jan 2006)
Deterministic Weather	→	Probabilistic Weather
Regional modeling & data assimilation	→	Regional to global modeling & DA
Atmosphere-land surface models	→	Atmosphere-land-ocean-chemistry models
Short-range WX prediction	→	Intraseasonal climate prediction



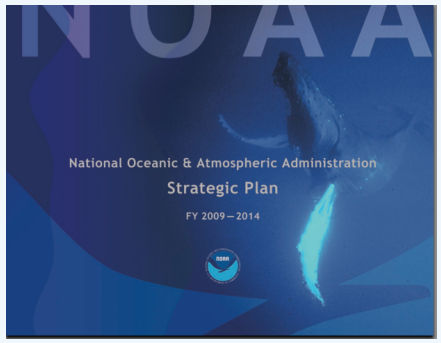
Relevance of GSD Research…

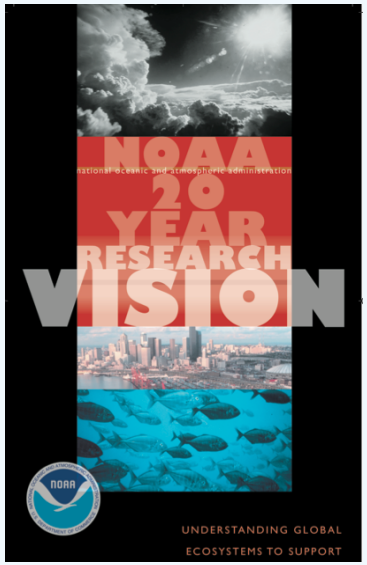




...to:

- *NOAA Mission Goals*
- *NOAA 5-year Strategic Plan*
- *NOAA 20-year Research Vision*
- *Weather & Water Goal Performance Objectives in the NOAA 5-year Research Plan*





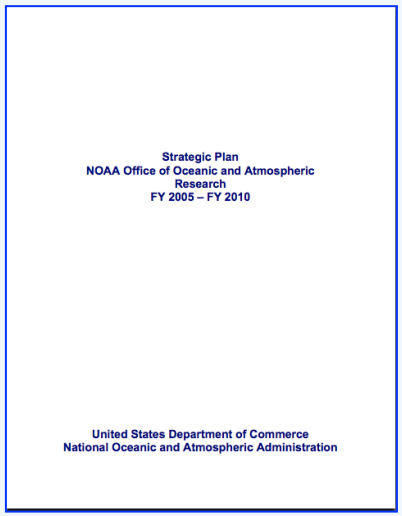
Weather & Water Performance Objectives

1. Increase lead time and accuracy for weather and water warnings and forecasts
2. Improve predictability of the onset, duration, and impact of hazardous and high-impact severe weather and water events
3. Increase development, application, and transition of advanced science and technology to operations and services
4. Increase coordination of weather and water information and services with integration of local, regional, and global observing systems
5. Reduce uncertainty associated with weather and water decision tools and assessments
6. Enhance environmental literacy and improve understanding, values, and use of weather and water information and services

…to Research Milestones for Improving Weather Forecasts and Warnings

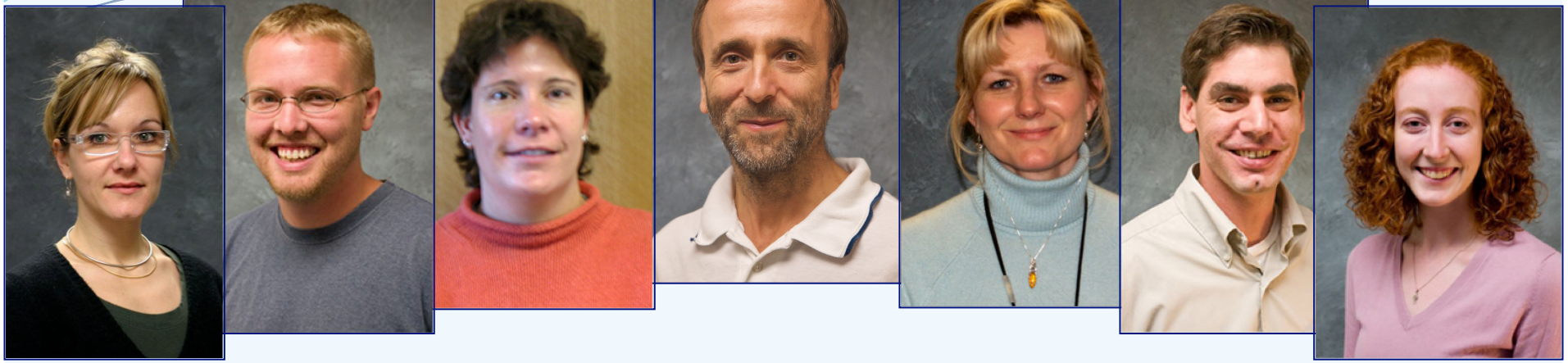
1. *Improve the forecast and warning verification system to relate more directly to user impact and to enable more rapid feedback loop for service improvements.*
2. *Improve accuracy in intensity forecasts for tropical storms and hurricanes through accelerated tropical cyclone modeling improvements.*
3. *Using testbeds, transfer research results into operations.*
4. *Determine viability of different data assimilation approaches.*
5. *Evaluate the utility of probabilistic forecasts for hazardous weather.*
6. *Develop an advanced air quality model by linking the WRF model to chemical processes.*
7. *Validate methodologies for acquisition, processing, and dissemination of weather-related data.*

…to Outcomes in the OAR 2005–2010 Research Strategic Plan

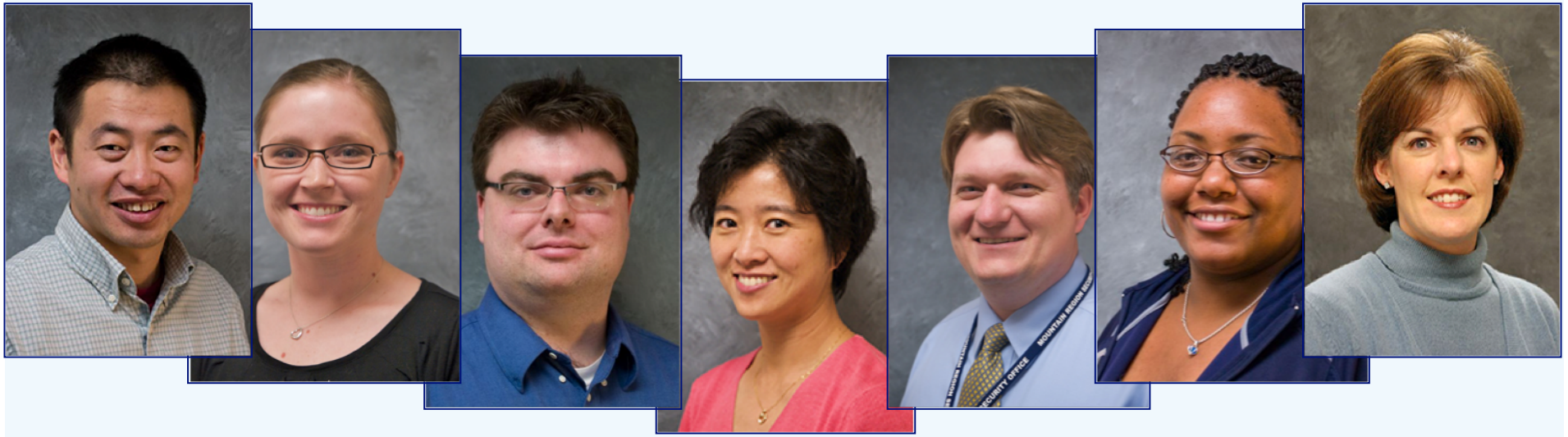


- Improve flash flood & 24-h precipitation forecast accuracy
- Radar data assimilation for improving tornado warnings
- Double hurricane intensity forecast skill
- Sustain and improve AWIPS capability
- Enhance environmental literacy (SOS, Virtual Worlds)
- Advance GPS-Met and UAS observing systems
- Meet model-based research/service needs of NOAA
- Meet operational requirements for model guidance

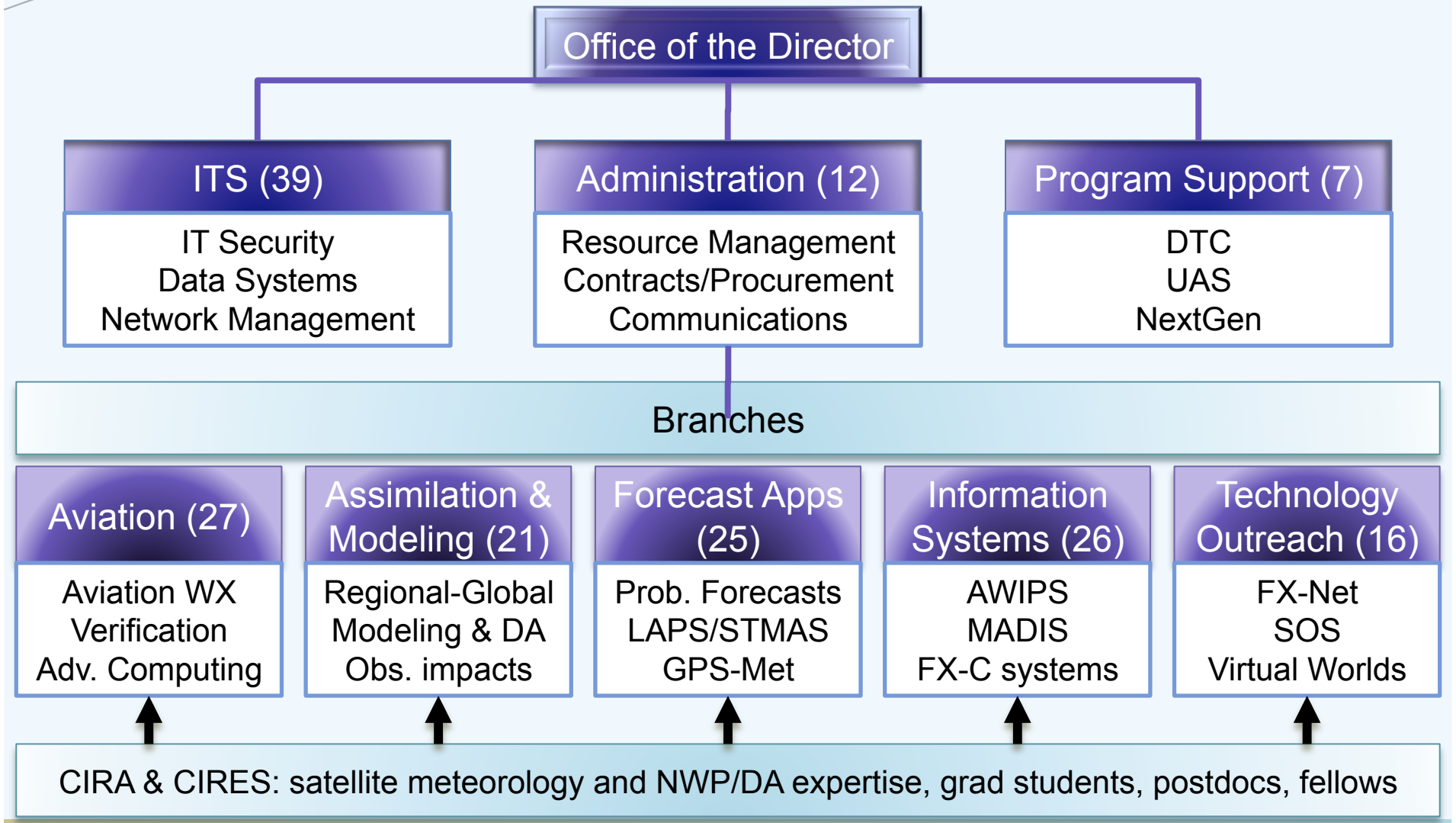
OAR Mission: To conduct environmental research, provide scientific information and research leadership, and transfer research into products and services to help NOAA meet the evolving economic, social, and environmental needs of the Nation.



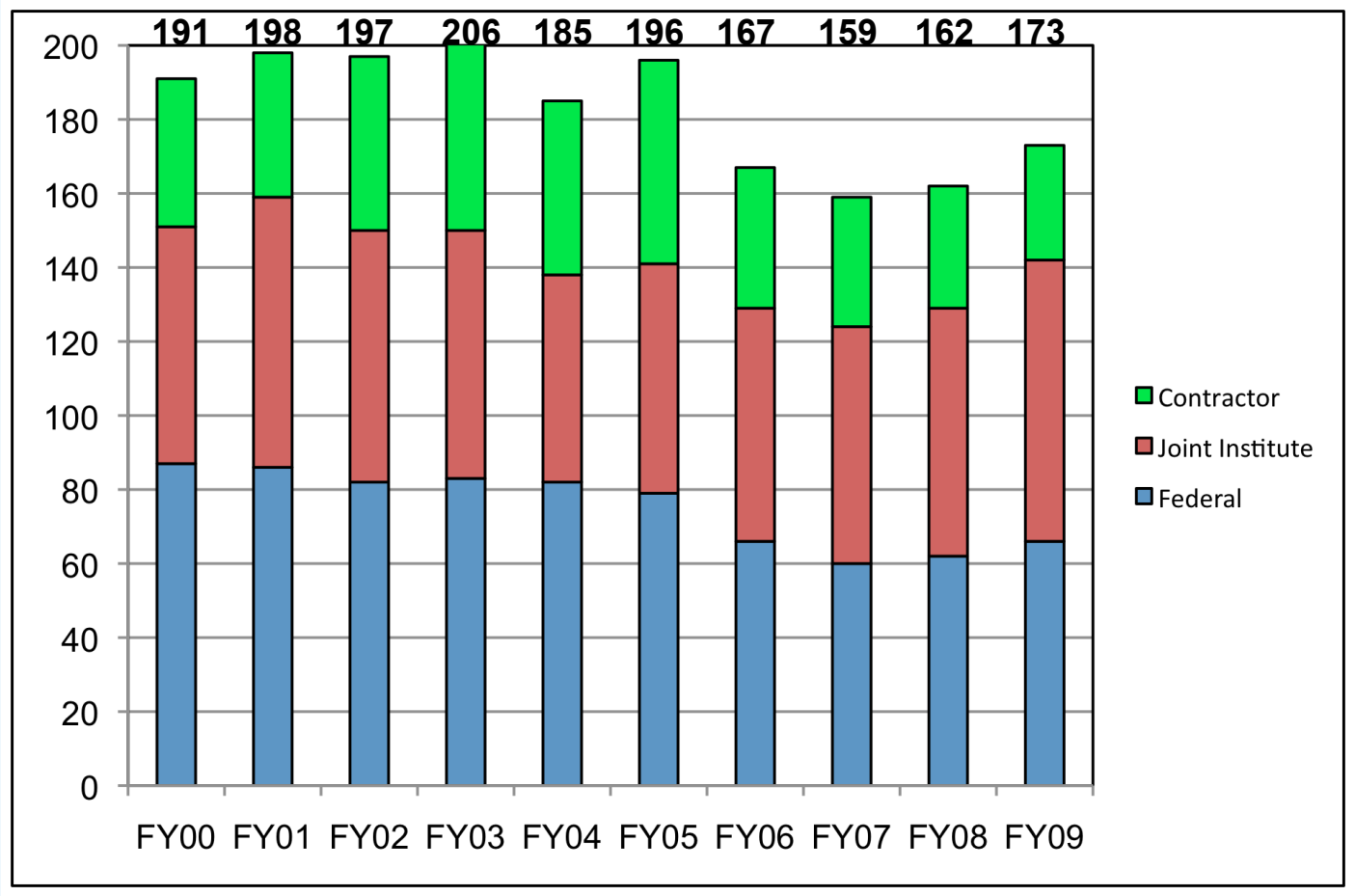
GSD Organization and People…



How We Are Organized:

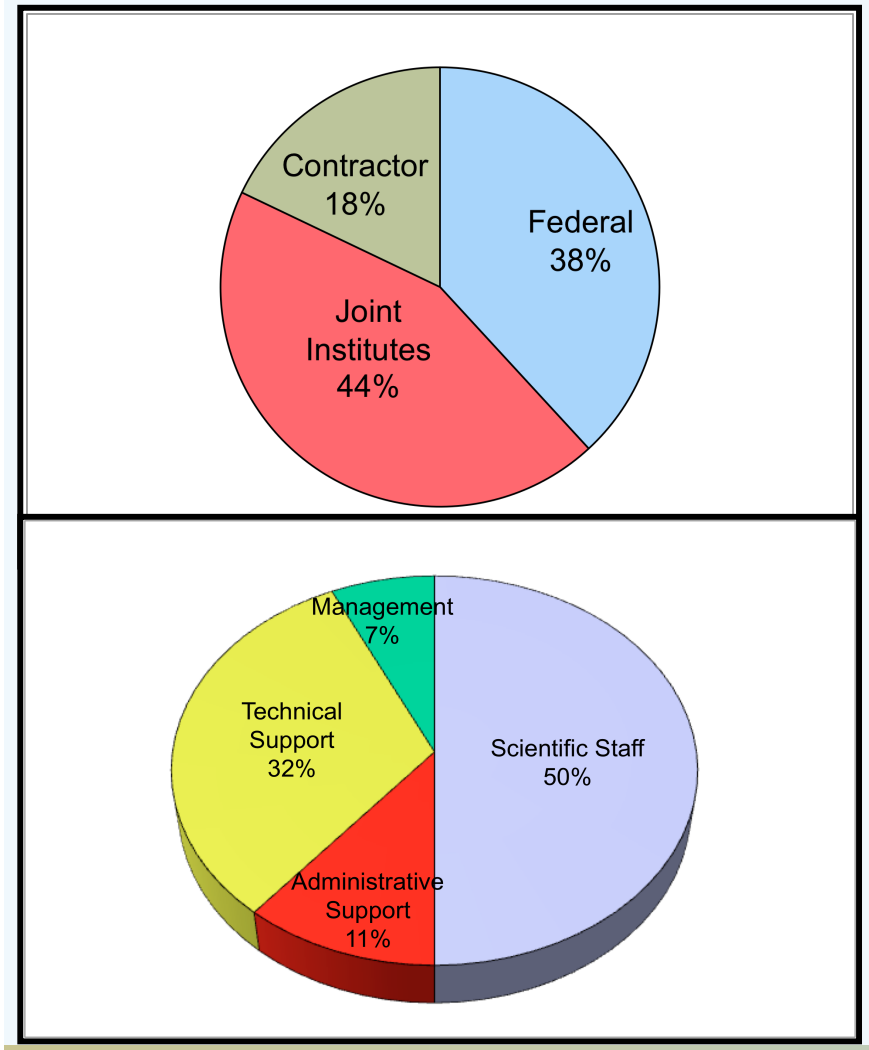


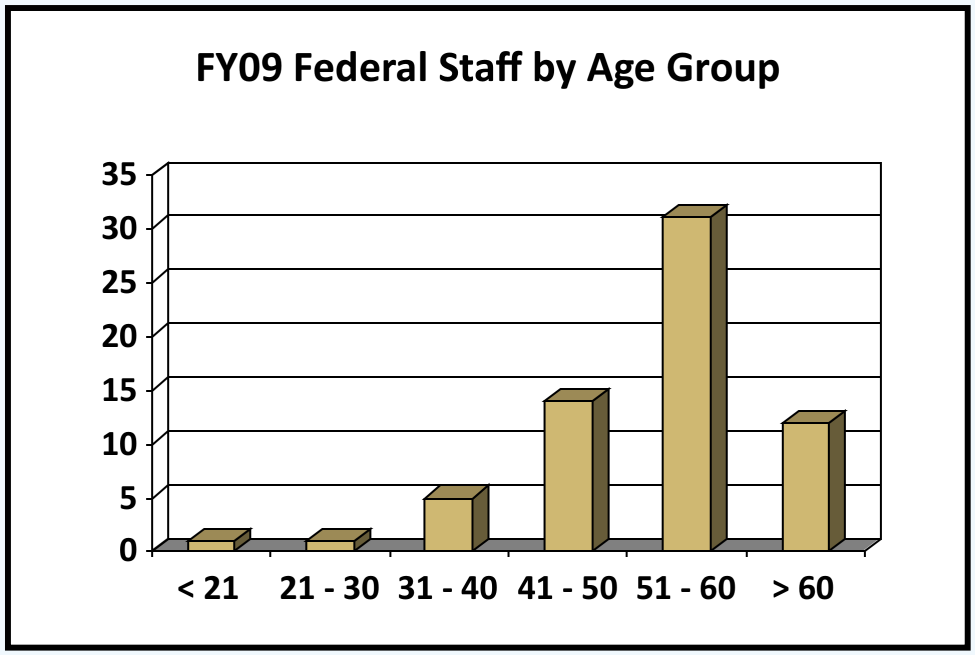
10-Year GSD Staffing Profile



Includes full-time, part-time, and student employees

GSD FY09 Staff Distribution

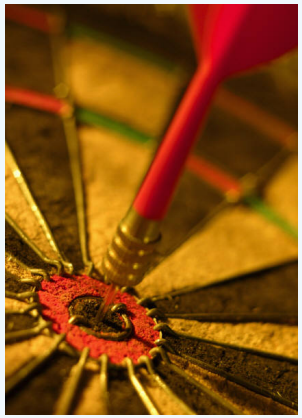




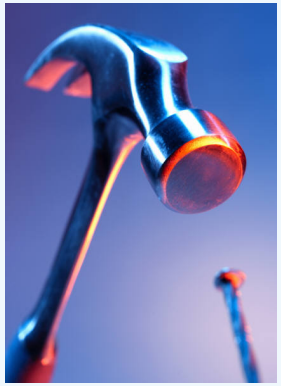
By FY13, 43% of the Current Federal Staff Will Be Eligible to Retire!

GSD FY09 Personnel Demographic Data

	Federal	Joint Institutes	Contractor	Total	%
African American	0	1	0	1	1%
Asian	4	9	3	16	9%
Caucasian	57	54	36	147	**85%**
Hispanic	3	0	2	5	3%
Native American	0	0	0	0	0%
Other	1	2	1	4	2%
Female	25	17	9	51	**29%**
Male	40	49	33	122	71%
Totals	65	66	42	173	



Measures of GSD Research Quality and Impacts of our R&D…



Quality: GSD Technologies Transferred to or Used by Operational Services

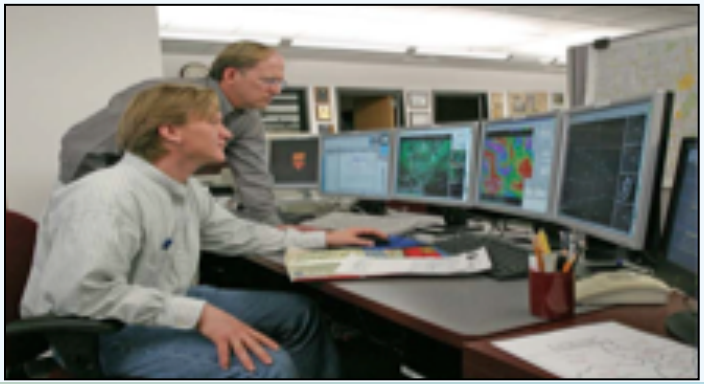
*Since 2000, **27** GSD research technologies have been transferred to or are used by operations at NWS Forecast Offices, NCEP/EMC, DOD, private industry, and international meteorological agencies:*

- Information Systems
- Observing Systems and Data Impact Studies
- Regional to Global Data Assimilation and Models
- Distributed Local High-Resolution Modeling Systems
- Aviation Weather Services & Assessments
- International Meteorological Systems

Quality: A Sampling of Award-Winning Impacts of GSD Technologies Transferred to Operations

Advanced Weather Interactive Processing System (AWIPS)

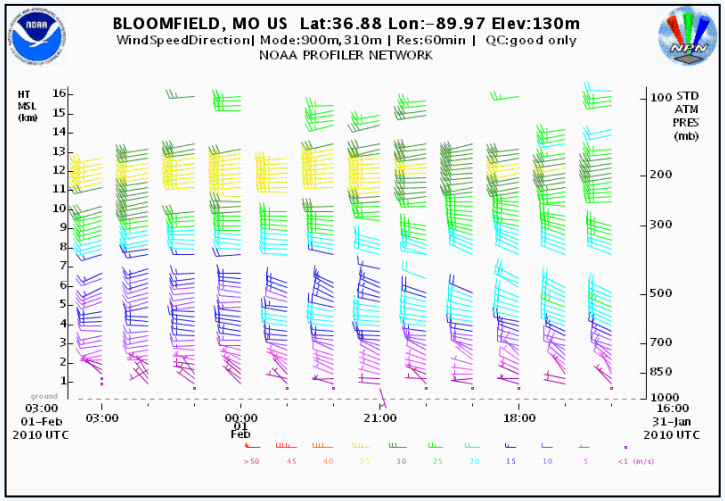
- Radically modernized NWS operational weather forecasting process
- Multiple operational builds from 1998 – 2010
- Decreased warning times by 2-3 minutes
  - *2000 DOC Gold Medal*
  - *2004 Bronze Medal*
  - *2005 NOAA Technology Transfer Award*



Quality: A Sampling of Award-Winning Impacts of GSD Technologies Transferred to Operations

NOAA Wind Profiler (NPN) Network

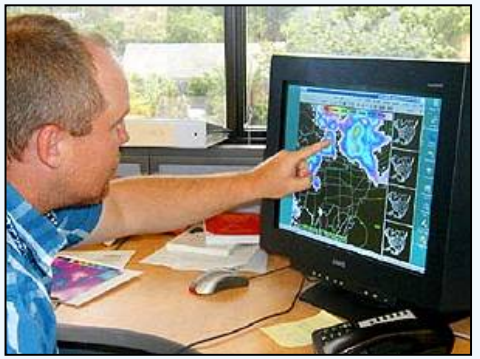
- Continuous hourly wind profiles since 1992
- Assimilated into RUC & NAM – significant reduction of short-range forecast errors
- 2006: Transferred responsibility for the maintenance, operation, and evolution of the NPN to NWS
- MOA with the NWS: MADIS sends profiler data to the NWS Gateway

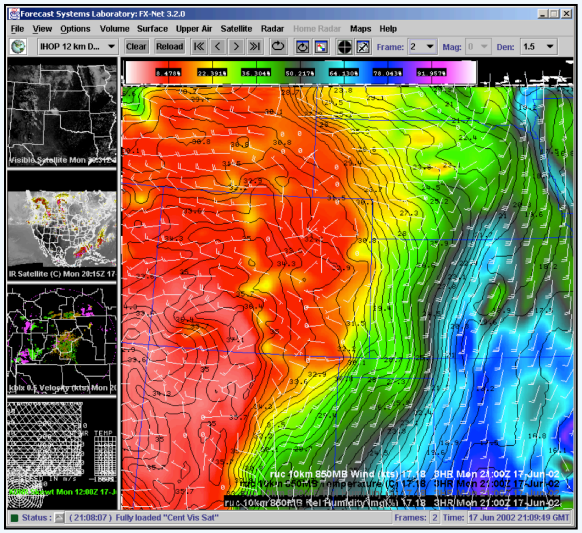


Quality: A Sampling of Award-Winning Impacts of GSD Technologies Transferred to Operations

FX-Net

- Critical support for NWS Incident Meteorologists (IMETS) since 2001
- Provides on-site weather forecasting for fire weather, floods, national events (e.g., Olympics)
- 2007: FX-Net transferred to private sector (Ensco, Inc. MetWise Net)
  - *2005 National Interagency Fire Center Honor Award*
  - *2007 NWS Director Certificate of Recognition*

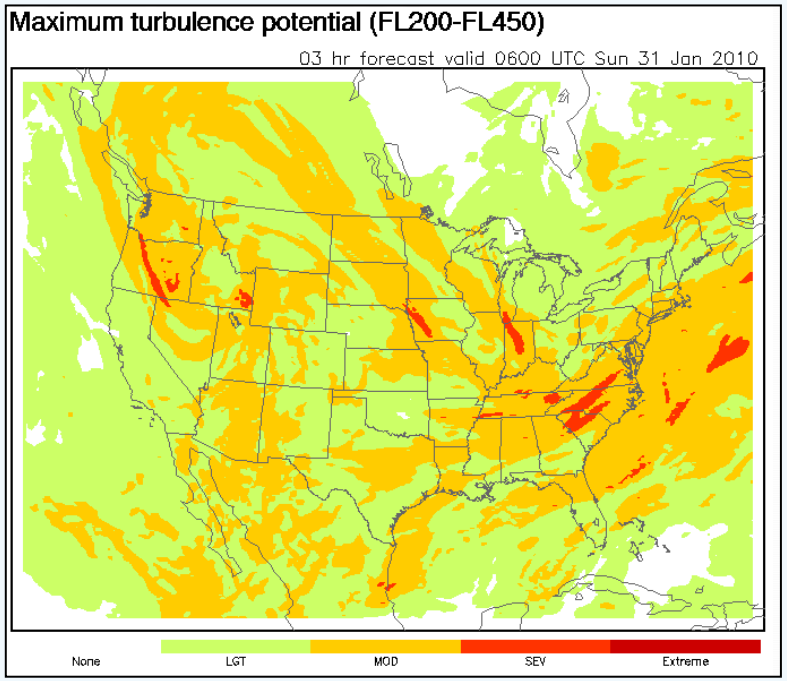




Quality: A Sampling of Award-Winning Impacts of GSD Technologies Transferred to Operations

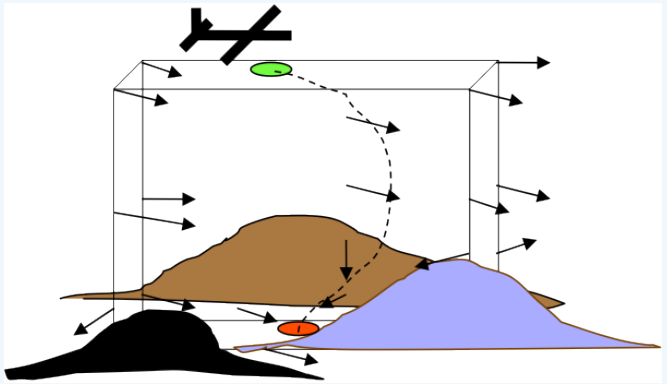
Rapid Update Cycle (RUC)

- Operational model at NCEP
- Serves needs of aviation and severe weather forecasting
- Most rapidly updated model running at NCEP
- Being replaced by WRF Rapid Refresh model by 2011
  - *1998 OAR Bronze Medal*
  - *2005 OAR Paper of the Year Award*
  - *2007 OAR Paper of the Year Award*



Quality: A Sampling of Award-Winning Impacts of GSD Technologies Transferred to Operations

Precision Airdrop System (PADS)

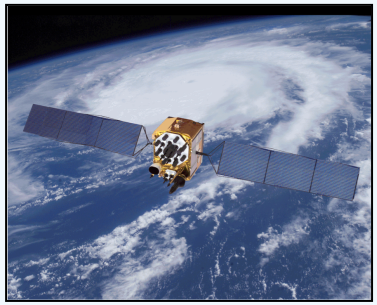


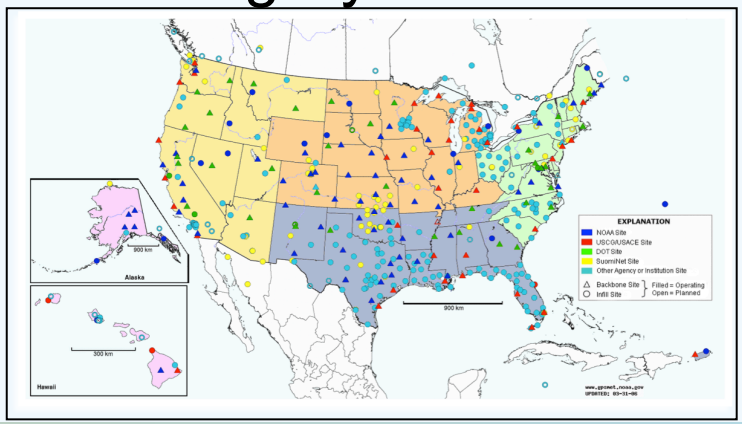
- Dropsonde from payload aircraft modifies very hi-res LAPS (Local Analysis and Prediction System)
- Used by DOD in Iraq and Afghanistan to reduce wind forecast errors by 70%
- Allows supply aircraft to fly at higher, safer altitudes
  - *2008 Technology Transfer Award*

Quality: A Sampling of Award-Winning Impacts of GSD Technologies Transferred to Operations

GPS-Met (Global Positioning System – Meteorology)

- A low-cost, highly leveraged, all-weather remote sensing system for measuring Integrated Precipitable Water (IPW)
- Successfully demonstrated weather/climate/ satellite sensor validation applications
- Essential to NOAA's Global Earth Observing System of Systems (GEOSS)
  - *2006 DOC Gold Medal*





Quality: Recognition From Our Customers

- *"GPS-Met provides **critical data** to support environmental modeling and local forecast warning and using GPS-Met in the RUC has deemed critical for detecting changes in moisture in severe weather situations"* – Dr. Richard Anthes, UCAR President in a letter to VADM Lautenbacher Jr.
- *"The MADIS (Meteorological Assimilation Data Integration System) Project is an **exemplary model** for a successful public-private partnership that ultimately benefits businesses as well as providing potential widespread societal benefits"* – Ron Sznaider, DTN Meteorologix Corp.
- *"The FX-Net is the '**backbone**' of fire weather forecasting in the field"* – Rob Balfour, NWS Incident Meteorologist
- *"The GFE provided a number of **important operational benefits** to support the provision of fire weather forecasts during this event"* – Jon Gill, Australia BOM during 2/09 devastating fire
- *"For sure, one of the **best ideas at the exhibition** this year was NOAA's bold move to create a virtual island on Second Life"* – Graeme Stemp-Morlock, Reporter at recent AAAS meeting

Quality: Awards Past 10 years

- 7 DOC Gold-Silver-Bronze Medals
- 18 NOAA Awards
  - Technology Transfer Awards, General Counsel Award, Administrator's Award, NOAA Employee of the Year Awards, etc.
- 6 OAR Awards
  - 4 Outstanding Scientific Paper Awards, 2 OAR Employee of the Year
- 20 non-NOAA Awards
  - Includes Service to America Award finalist to A. E. MacDonald for Science On a Sphere®

Major Collaborations

G

S

D

FAA

- Next Generation Air Transportation (NextGen)
- NextGen Network-enabled Weather (NNEW)
- Aviation Weather Research Program (AWRP)

NWS/ NCEP

- AWIPS
- Graphical Forecast Editor (GFE)
- Rapid Update Cycle (RUC) and WRF Rapid Refresh (WRF-RR) models

NCAR & NASA

- AWRP modeling & algorithms
- Developmental Testbed Center (DTC)
- Satellite product impacts & data assimilation

AOML NSSL ARL

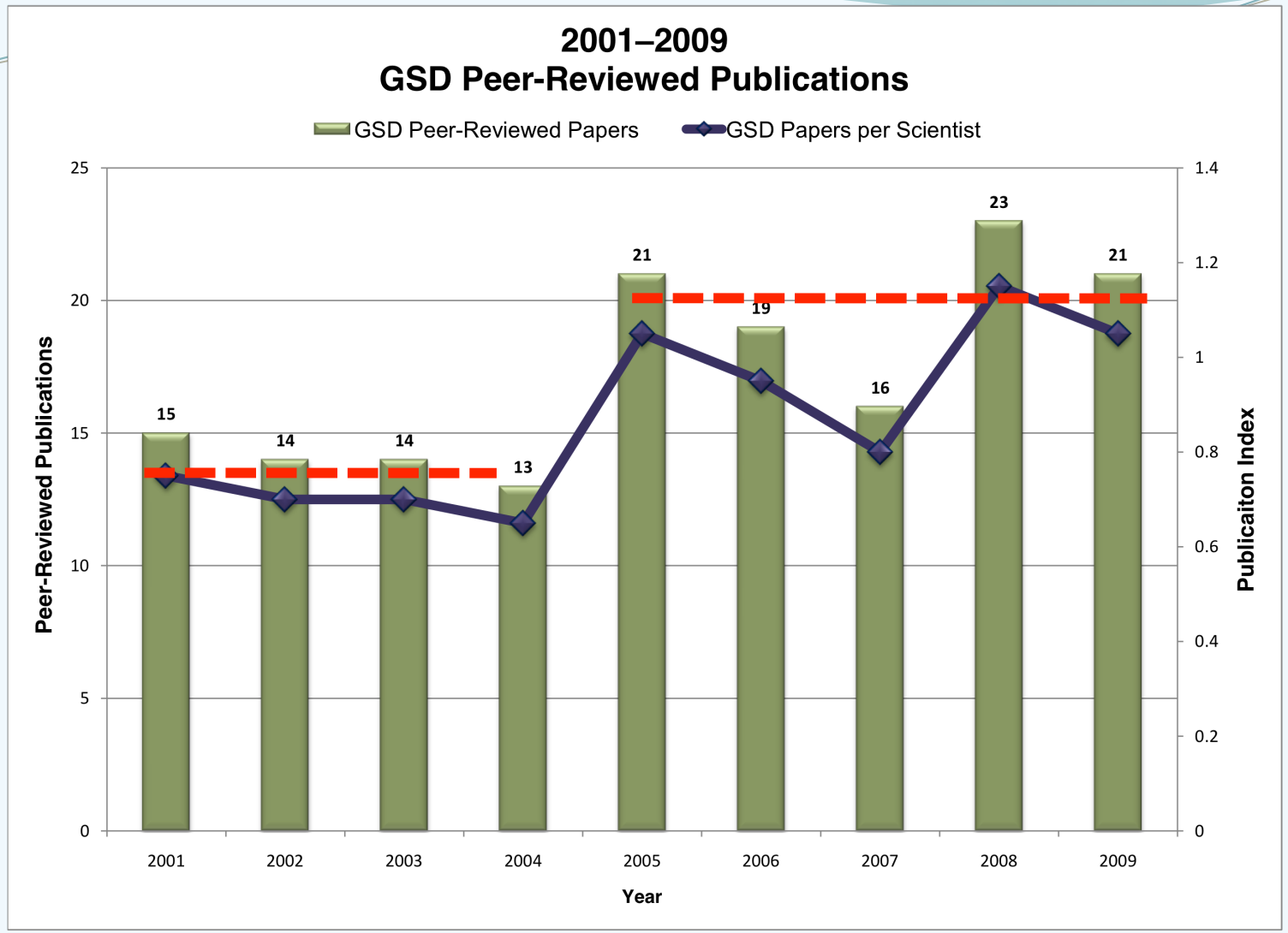
- AOML: Hurricane Forecast Improvement Project and DTC Hurricane WRF model
- NSSL: Warning On Forecast
- ARL: WRF-Chem

Quality: Citations for Authors with an H-Index ≥ 10

Authors	Citations	Hirsch Index
1. Rainer Bleck	4,258	26
2. Zoltan Toth	1,933	22
3. Steven Koch	1,365	19
4. Stan Benjamin	1,368	18
5. Georg A. Grell	1,382	17
6. Tomi Vukicevic	695	15
7. John M. Brown	828	14
8. Tom Schlatter	594	12
9. Betsy Weatherhead	472	11
10. Steven Peckham	301	10

Tenured Full Professor = 18

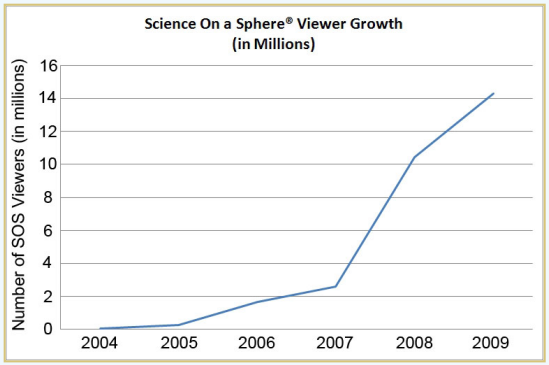
Tenured Associate Prof = 10-12



Note: The publication count for GSD in 2009 includes in-press as well as published peer-reviewed publications.

Quality: Outreach and Media

	2007	2008	2009	TOTAL
NOAA News Releases	4	11	5	20
External News Releases	12	26	16	54
Media Interviews	3	1	8	12
Newspaper Stories	43	80	49	172
TV and Radio Stories	0	0	8	8
On-line Multimedia Stories	21	36	44	101
TOTAL	83	154	130	367
Executive Management Team Submissions	14	13	8	35
OAR Hot Items	22	22	20	64
Online NOAA Stories	5	18	17	40
TOTAL	41	53	45	139
Science on a Sphere Viewer Growth (millions)	2.5	10.2	15.0	



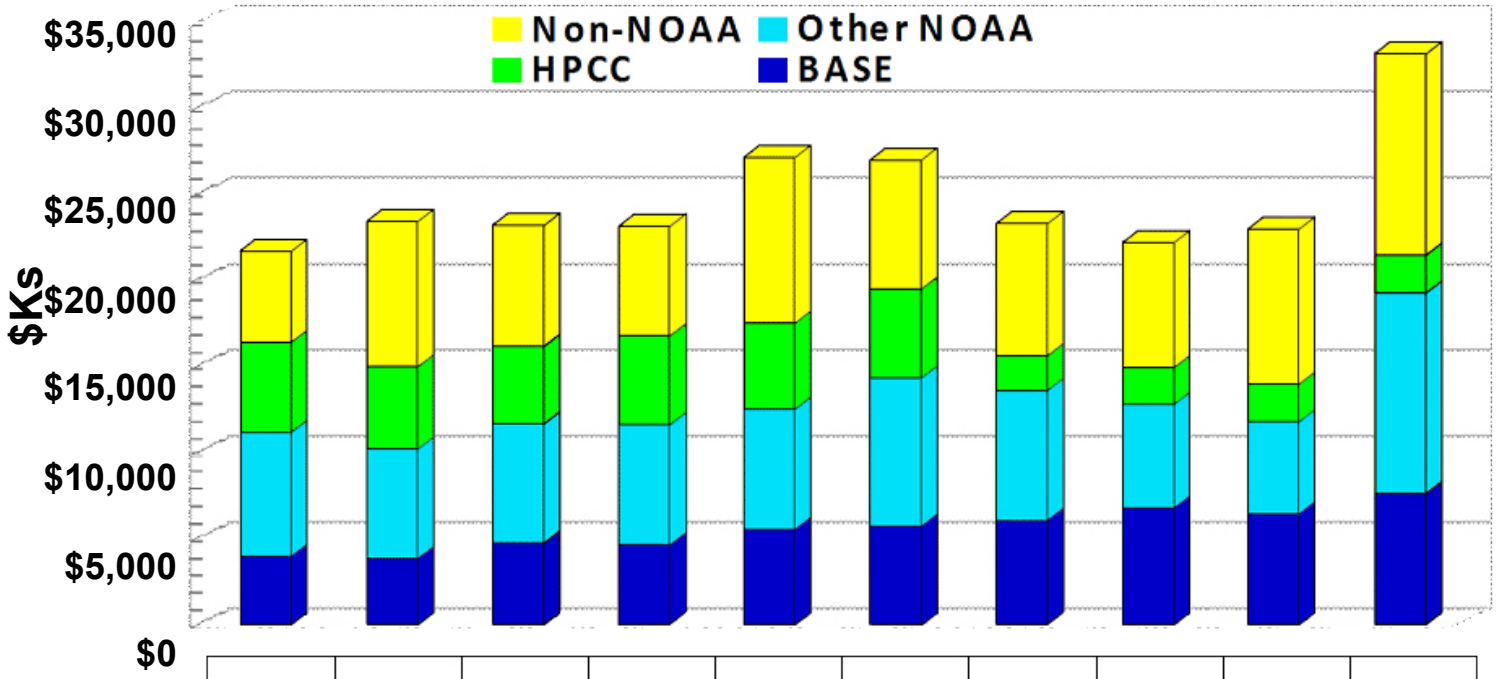
GSD web sites receive > 42 million hits each year.

GSD reaches out to the local community through the Boulder Outreach and Coordinating Council and the ESRL Outreach Team. There are typically 60-90 events each year.

Performance Measures…

GSD has its finger on the pulse of changing national, NOAA, and customer priorities and requirements

GSD Funding FY00–FY09
(GSD was Forecast Systems Laboratory before 2006)



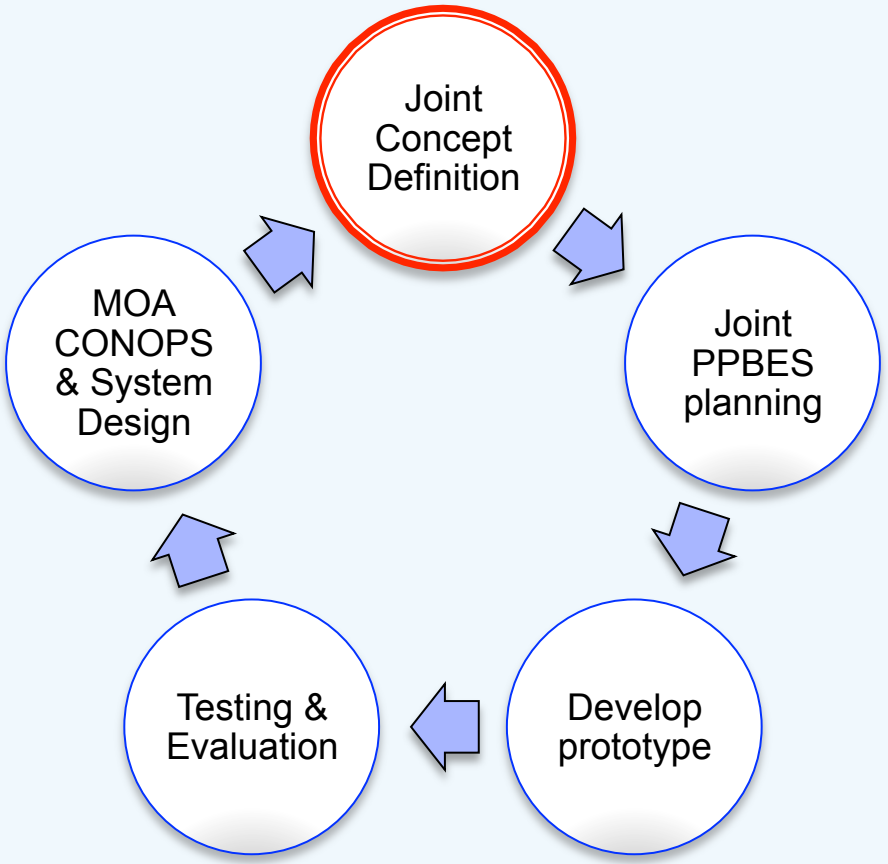
	FY00	FY01	FY02	FY03	FY04	FY05	FY06	FY07	FY08	FY09
BASE	$4,000	$3,881	$4,780	$4,698	$5,588	$5,758	$6,086	$6,806	$6,457	$7,644
Other NOAA	$7,227	$6,288	$6,919	$6,944	$6,950	$8,570	$7,490	$5,977	$5,343	$11,630
HPCC	$5,187	$4,840	$4,494	$5,098	$5,002	$5,129	$2,000	$2,153	$2,191	$2,206
Non-NOAA	$5,275	$8,404	$7,029	$6,406	$9,610	$7,475	$7,718	$7,277	$8,949	$11,682
Yearly Totals	$21,690	$23,413	$23,222	$23,146	$27,150	$26,933	$23,293	$22,214	$22,940	$33,163

NOTE: GSD NOAA Funding has consistently kept up with the 125% rule for funding federal employees. However, after accounting for CPI and labor inflationary factors, GSD real purchasing power reduced from 2003 to 2008.

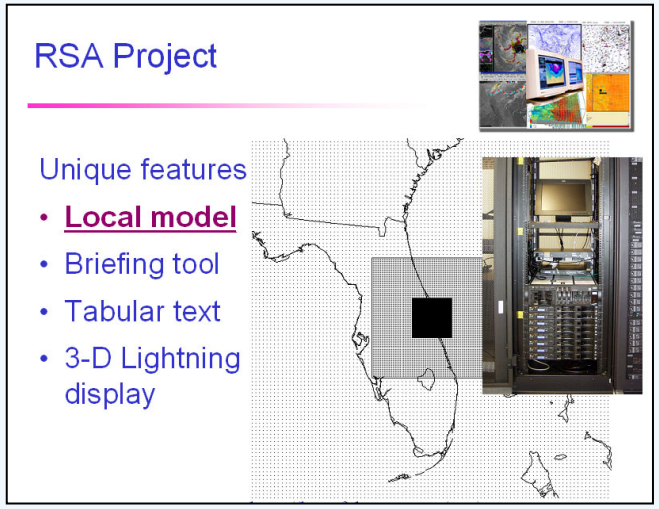
Performance: Effectiveness of GSD Transition of Research To Operations (RTO)

- GSD has transitioned over 26 projects to operations over the past decade to NWS Forecast Offices (AWIPS, LAPS), NCEP (RUC/Rapid Refresh), private sector (Lockheed Martin), and even other countries (GFE).

- Stakeholders are involved throughout the entire RTO process from concept definition to implementation:



Performance: Effectiveness of GSD Transition of Research To Operations



Prioritization of project support is determined by a combination of PPBES planning, NOAA Program Decision Memorandum, OAR Integrated Priority Lists, and amount/stability of funding (including reimbursable funds)

Projects are **terminated** on a case-by-case basis after transitioning (e.g., NPN Profiler), or customer support / reimbursable funding ends (e.g., some private sector and international projects).

Performance: Establishing Research Priorities

- GSD updates its vision, long-range planning, and priorities at annual Futures Conferences. Director allocates base funds each year using this guidance along with annual Program Decision Memorandum and OAR priorities list.
- Director Discretionary Funds support 3–5 projects each year on the basis of scientific merit, technological maturity, and evolving priorities (see above). Successful projects are proposed for funding through NOAA budget process.
- GSD has been very active and successful in PPBES planning of new initiatives, e.g., 10 out of 11 submitted by GSD in FY07 have since received funding.

Challenges and Directions for the Future

- Addressing short-term NWS requirements while investing in long-term R&D needed for global-to-local observing, prediction, and information systems in 20 years
- Challenge: Diversification and age of workforce
- Continuing to evolve our mission from our earlier mission as Forecast Systems Laboratory (technology transfer to weather services) to future scientific challenges spanning the temporal spectrum from local Warn On Forecast to global intraseasonal climate forecasting
- Defining role of GSD in future NOAA organization during creation of Climate Service Line Office